Agriculture-Forestry Options[1]

The options discussed in this option include the following goals related to reducing GHG emissions and increasing carbon sequestration in agricultural and forestry management. It is important to recognize that carbon sequestration is a major element of Utah's GHG inventory, but more information is needed regarding Utah's inventory. The Utah specific GHG inventory indicates large amounts of carbon (compared to emissions) are sequestered in forest land annually.[2] There are significant uncertainties in the inventory, however, and more recent data is available in the Appendix to this report.

1. Agriculture
    a. Reducing carbon emissions by encouraging production of biomass fuels
    b. Reducing methane emissions
        i. Improved manure management
        ii. Changing livestock feed
    c. Increasing carbon sequestration
        i. Encouraging innovative soil management
        ii. Converting lands to grasslands or forests
        iii. Preserving open spaces/agricultural lands

2. Forestry
    a. Increasing carbon sequestration through
        i. Protecting forests and planting trees
            1. Protecting forestlands by reducing conversion to non-forest uses
            2. Encouraging afforestation or restoration of nonforest lands
            3. Promoting urban and community trees
            4. Encouraging reforestation, proper stocking, and density management
            5. Developing best management practices for biomass removal
        ii. Improving forest health in general
            1. Improving fire management and risk reduction
            2. Improving forest health
        iii. Expanding use of wood products for building materials
    b. Reducing carbon emissions by
        i. expanding use of forest biomass feedstocks for energy production
        ii. expanding use of wood products for building materials (thereby reducing emissions from not producing alternative materials).

[1] The following SWG members have participated in calls and meetings of this group: Randy Parker, Kathy Van Dame, Sarah Wright, Ron Daniels, and Paul Dremann. Others who have participated include:
Geoff McNaughton, Roy Gunnell, Sara Baldwin, Carl Hansen, Richard Beard, Tim Wagner, and Andre Shoumatoff.

[2] Greenhouse Gas Inventory and Reference Case Projections, 1990-2020; Center for Climate Strategies, February 2007 http://www.deq.utah.gov/BRAC_Climate/docs/Final_Utah_GHG_I&F_Report_3-29-07.pdf]

AF-1[3] - Promote Production of Biomass Fuels

This option includes promoting the production of ethanol, biomass, biodiesel, cellulosic ethanol, and other bio-fuels.

Benefit/Cost of Reducing CO_2e:

Arizona:	28 MMt between 2007-2020; $0/ton
New Mexico:	7.5 MMt between 2007-2020; $3/ton
Colorado:	0.1-1 MMt or more; $5-50/ton; includes starch and cellulosic processes

Assessment: Medium Priority. Bin B.

We recommend the state support further R&D for biofuels to examine Utah's potential to produce and/or manufacture low-carbon, ag-based fuels and energy resources. There is a need for more information and R&D of all biofuels (high priority). But actual implementation in near term is limited (medium priority). Water usage is an important constraint.

The Utah Biodiesel Cooperative reports that biodiesel produces a 78% reduction in GHG per unit of fuel. UDOT and Utah State University are currently undertaking an experiment along Utah's highways to grow biodiesel feedstocks, which will be converted into biodiesel fuel, possibly meeting UDOT's entire fleet needs.

Ethanol: little corn is grown in Utah; cellulosic ethanol depends on future technology.

Feedstocks discussed for biofuel production in Utah included:

- Algae,
- Oil-producing plants,
- Manure,
- Switchgrass
- Pinyon-Juniper woodlands.

[3] This option combines the old AF 1 and 2.

AF-2 – Improve Manure Management[4]

This broad, umbrella option includes composting, manure, manure digesters, and optimal application of nitrogen fertilizers.

Benefit/Cost of Reducing CO_2e:

Arizona: 3.8 MMt between 2007-2020; $1/ton
New Mexico: 6.3 MMt between 2007-2020; $3/ton[5]
Colorado: 0.1-1.0 MMT; unknown cost

According to the Utah DNR 2000 report, assuming that some practices will be adopted, one might assume that nitrogen emissions could be reduced by 5 percent. Based on the 2010 forecast of 127,290 tons of CO_2 equivalents, this translated into a savings of 6,365 tons.[6]

Assessment: Medium Priority. Bin B.

This option presents some good opportunities in Utah, while also offering the potential to important co-benefits, such as reduced water pollution and noxious odors. Farmers generally do a good job with nutrient management but there are problems in urban areas with home/hobby gardening. In Utah, there has been some interest in generating electricity from manure onsite and providing excess to the grid. Some research is being conducted at USU on this and related technologies. Digester technology is being improved and there are examples of manure management.[7] Manure digesters have been used in Northern Utah and also on a dairy in Sanpete County. The technology is still somewhat early for commercialization and needs more R&D to improve its viability. Some efforts have been abandoned due to technical problems related to the quantity of natural gas produced from manure to generate electricity and engine corroding agents from the gas produced. However, this option may hold additional value because it reduces the flaring of methane, and methane is much more potent GHG than is CO_2.

Utah has identified and inventoried 99% of the State's feeding operations. Included in the inventory process is a plan for managing waste—land application as compost. Estimates suggest that better practices could reduce nitrogen fertilizer use by as much as 20 percent. At this level, there is a low risk of yield penalty and the added possibility of input-cost savings to farmers.[8] Improved management practices coupled with specific technologies may achieve energy savings by reducing the need for plowing and other energy intensive practices. Practices which could be improved include application rates, placements, and timing, soil testing frequency, low-nitrogen and/or fertilizer use, and conservation tillage. Technical approaches that could be followed include the use of fertilizer additives that increase nitrogen-use efficiency by decreasing nitrogen loss through volatilization, limiting or retarding fertilizer water solubility through super-granulation, and reducing nitrogen release. To a large degree, the modification of fertilizer practices is dependent on establishing effective ways of disseminate the knowledge of new practices.

---

[4] This option combines the old AF 3, 5, 7, and 8 options.
[5] Projected for digester systems used on dairies, not feedlots.
[6] Utah Department of Natural Resources, 2000.
[7] See Circle Four/Smithfield Farms in Milford.
[8] Utah's State Action Plan

AF-3 - Change Livestock Feed and Improve Productivity to Reduce Methane Emissions

Improved Ruminant Productivity programs increase the efficiency of dairy and beef cattle and other ruminant operations.[9]

Benefit/Cost of Reducing CO_2e:

Arizona: 4.5MMt between 2007-2020; $-8/ton
New Mexico: 2.6MMt between 2007-2020; $-76/ton[10]
Colorado: 0.1-1.0 MMt; negative cost

The 2000 Utah DNR report indicated that according to industry estimates, methane emissions could be reduced by up to two percent per year if the above practices are employed. At this rate, 284,577 tons of CO_2 equivalents could be reduced by 2010 for a total of 1,271,105 tons emitted.[11]

Assessment: Medium Priority. Bin B.

If there are ways to shift feed rations that can impact methane emissions, then this is almost a "no brainer."

USU is doing a lot of research on this issue. Competitive pressures to increase efficiency will encourage the dairy and beef industries to adopt some or all of the short-term process changes described. Improving productivity within the cow-calf sector of the beef industry requires additional education and training. The importance and value of better nutritional management and supplementation must be communicated. Energy, protein, and mineral supplementation programs tailored for specific regions and conditions need to be developed to improve the implementation of these techniques. The special needs of small producers must also be identified and addressed. There may be some manure management/methane opportunities further into the future.[12]

---

[9] Utah 2000
[10] Biomass feedstocks for steam, electricity, or direct heat
[11] Utah 2000
[12] Circle Four Farms in Milford is currently looking into this.

AF-4 – Encourage Innovative Soil Management [13]

This umbrella option includes encouraging a variety of management options for increasing carbon sequestration, such as:

- Conservation tillage/no-till agriculture to increase carbon sequestration of the soil and reduce energy use from reduced tractor use. More research is needed to determine whether this approach to planting crops reduces CO_2 released from soils.
- Reduce summer fallow
- Increase winter cover crops
- Rotational grazing/Improve grazing crops
- Improve water & nutrient use – While there are significant co-benefits here, including a reduction in runoff and soil erosion, the main impact is on water use. There is only a peripheral carbon impact.
- Organic Farming - includes integrated pest management through biological rather than chemical means. It increases the carbon content of soils because manure, rather than commercial fertilizer, is used.

Benefit/Cost of Reducing CO2e:

New Mexico: 0.6MMt between 2007-2020; $15/ton
Colorado: 0.1-1.0 MMT; $5-50/ton

Organic farming:
New Mexico: 4.4 MMt between 2007-2020; $0.5/ton
Colorado: 0.1-1.0 MMt; less than $5/ton

Assessment: Medium Priority. Bin B.

Based on the makeup of Utah cropland, this is a medium priority. This is not a large emissions reduction item, but something that should be considered. New Mexico's niche market for organic food production has been growing faster than Utah's (this may impact why New Mexico found larger potential for organic farming.) More investigation in this option may help determine Utah's potential to tap into the growing organic farming market. Most of the organic farming benefits noted by New Mexico came from soil sequestration (carbon in soil). The information was unclear as to the benefits associated with reduced pesticides and fertilizer vs. soil management. Colorado noted that sequestration is believed to be greater in organic farmland than conventionally farmed land.

Soil management is already being done in some areas of the ag industry, which provides a reduction in the amount of energy required to work with the soil. There may be additional sequestration benefits from improved soil management.

[13] Includes old AF 11, 12, 13, 14, and 19 options.

AF-5 - Convert Land to Grassland or Forests

Benefit/Cost of Reducing CO_2e:

New Mexico: 4 MMt between 2007-2020; $7/ton[14]
Colorado: 0.1-1.0 MMt; unknown

Assessment: High Priority. Bin B.

We have a large opportunity for benefits here if the investment is made. The type of grasslands would need to be tailored to water availability. There is some uncertainty as to the overall emissions benefit of this option, but there may be some opportunities. There is also a benefit of increasing agricultural lands for adaptation.

The United States Department of Agriculture, under the Conservation Reserve Program (CRP), pays farmers to retire agricultural lands that are highly susceptible to erosion. This has been very successful for marginal lands. Farmers are usually paid a certain amount per acre per year for 10 years The Natural Resources Conservation Service has data on the amount of lands under CRP in Utah.

Foresters are interested in this as a model for stream buffer requirements. It's important to address what's being converted and from what. The benefit is that the coverage could be permanent.

Oregon specifies that marginally productive agricultural and brush lands are to be converted. The second projection is for Oregon's policy option that calls for the "leverage" of the Conservation Reserve Program which provides farmers with incentives to convert agricultural land and rangeland to forest.

Other states require forests to set aside a buffer strip to protect riparian areas. Utah does not since farmers are paid to do this. Forest owners could also be paid to create these buffer lands.

There could be carbon credits associated with this measure. There was some concern that that this is too short term (~10 years) for credits.

[14] Emissions reductions are taken against emissions that have not been built into the existing forecast for NM. They refer to emissions associated with acreage assumed to be coming out of the Conservation reserve program and returned to active cultivation. Since they aren't included in the baseline, these reductions are left out of the totals.

AF-6 - Preserve Open Space/Agricultural Land

Benefit/Cost of Reducing CO_2e:

Arizona: 1.6 MMt between 2007-2020; $65/ton
New Mexico: 1.6 MMt between 2007-2020; $62/ton
Colorado: 0.1-1.0 MMt; unknown cost [15]

Assessment: High Priority. Bin B.

Preserving open space and agricultural land should be a high priority for Utah in the face of a rapidly growing population and increasing development. While this effort may require some concerted effort among private and public stakeholders, along with federal and state governments, a coordinated effort to preserve open space and agricultural land will provide numerous benefits in the short and long-term relating to climate change, air quality, water quality, and quality of life. This is an important option near urban centers, but may be difficult to accomplish in the face of development pressure. Other states show this option to have a high cost per ton of carbon emissions, but this option has important co-benefits for ranching and forestry. It is not clear what the true costs and benefits are/will be for Utah, as they have not yet been evaluated. Preserving open space and agricultural land also coincides with other climate change options relating to transportation, renewable energy, and land use.

Sequestration and uptake is greater in agricultural land than other land uses.

Lands could be protected through conservation easements. The Federal Forest Legacy Program through USDA Forest Service provides about $2-3 million a year to Utah. A similar effort could apply to ranches. The state should expand the LeRay McCallister program to protect open lands.

This option could include promoting "no net loss" of agricultural land.[16]

[15] Reductions here occur from higher carbon retention in soil and decreased transportation activity.
[16] This option includes the old AF-17 option.

AF-7 - Protect Forestland by Reduced Conversion to Non-Forest Uses (Urban, Suburban, and Rural Lands)

Benefit/Cost of Reducing CO_2e:

Arizona: 3.7 MMt between 2007-2020; $17/ton
New Mexico: 1.2 MMt between 2007-2020; $22/ton
Colorado: 0.1-1.0 MMt or higher; $5-50 or higher[17]

Assessment: High Priority. Bin B.

The benefits here are similar to those for AF-6.

Healthy forests promote carbon sequestration and reduce carbon releases. This option has significant co-benefits such as wildlife habitat, recreational opportunities, water and air filtration, and reduced risk of fires. As the climate changes, it is anticipated that fires will become more severe, and will occur earlier in the year.

Utah should promote existing wildland-urban interface and conservation easement programs. Federal funding is available for these types of projects. In 2006, the State lost over $1 million in funding from federal government; so there is concern about future funding. The Federal Forest Legacy program seems to prioritize Eastern states; the case should be made for more funding to western states. The LeRay McCallister program could be expanded. Other sources include WUI protection program, and Quality Growth Fund (promoting existing WUI and Federal and State open lands protection/conservation easement programs).

[17] Reductions depend on current rates of clearing; large amounts of carbon can be protected per acre.

AF-8 – Encourage Afforestation and or Restoration of Nonforest land

Benefit/Cost of Reducing CO_2e:

Arizona:	0.7 MMt between 2007-2020; $44/ton
New Mexico:	Residential: 2.5 MMt between 2007-2020; $-46/ton
	Other: 6.3 MMt between 2007-2020; $-15/ton
Colorado:	0.1-1.0 MMt; $5-50/ton or higher[18]

Assessment: Medium Priority. Bin D.

This should apply to rural forests only. Compare with AF-9.

The assumption is that healthy, productive trees can reduce carbon. Forests can sequester as well as release carbon. They also contribute to warming/cooling cycles through absorption/reflection Scientists are debating whether there is a net benefit from planting trees.[19] Some models suggest that the reduction in albedo (reflectivity) from darker trees can contribute to a net warming in temperate and northern forests, despite the tree's carbon uptake.

[18] Reductions depend on available land; high rate of sequestration per acre.
[19] See Lawrence Livermore study discussed in Society of American Forestry, Forestry Source, February 2007

AF-9 - Promote Urban and Community Trees[20]

Benefit/Cost of Reducing CO_2e:

Colorado: less than 0.1 MMt; less than $5-50/ton[21]
Oregon: not cost effective over action's lifetime

Assessment: High Priority. Bin A.

There are opportunities for carbon uptake here. Other benefits are cooling and reducing the need for air conditioning, thereby reducing the carbon associated with electricity production.

Urban and community tree programs are very popular with the public. Through the Tree City USA program, cities that enact ordinances, and require spending on trees can receive federal funding. Other existing programs include Utah Community Forest Council, and the State's urban and community forestry program. The state allocated $200,000 for urban forestry this year. A 37% reduction in next year's federal budget is anticipated so state money was very timely.

There is an ongoing need for people to have information about residential tree planting. An educational program would be useful.

Strategic planting of urban trees can have an energy conservation effect through shading and transpiration cooling of residential and commercial structures. This conservation effect can have a larger impact on CO2 emissions than the sequestration provided by urban trees and can be large enough to offset the emissions associated with fossil-fuel powered tree maintenance equipment. Importantly, urban tree-related energy conservation represents a permanent avoidance of the CO2 emissions that would have been used to provide space conditioning for urban structures, while the sequestration benefits of urban and other trees are reversed when the trees ultimately decay.[22]

[20] Previously called Increased Maintenance of Urban Street and Residential trees.
[21] Cost savings are possible if material from maintenance are directed towards product and energy use.
[22] Effects of Urban Tree Management and Species Selection on Atmospheric Carbon Dioxide, Nowak, Stevens, Sisinni, and Luely, Journal of Arboriculture 28(3): May 2002, 113.

AF-10 – Promote Reforestation, Proper Stocking, and Density Management of Managed Stands[23]

Benefit/Cost of Reducing CO_2e:

Colorado: 0.1-1.0 MMt; $5-50/ton or higher[24]
0.1-1.0 MMt or higher; less than $5 – 50/ton[25]

Assessment: Medium Priority. Bin C.

Most of Utah's forests are federally owned and are covered by US Forest Services' reforestation requirements.

A voluntary forest stewardship program covers private lands. Cost-sharing and education encourages owners to use best management practices (BMPs). The state Forest Stewardship Program offers planning services. Landowners can also get funding to cover their expenses, but they must meet matching requirements (which may include sweat equity). State foresters are available to help landowners, but they encourage landowners to do a forest stewardship plan and take a long-term focus. A recent audit showed Utah's private landowners are voluntarily implementing BMPs 89% of the time. Increased incentives and education, rather than a regulatory hammer, may be the most effective method to expand this program's effectiveness.

A USU program trains timber companies on land management practices. USU brochures offer tips to land owners on recognizing responsible logging companies. It also provides sample timber sale contracts.

Age extension of forest stands – extending rotation to extend sequestration - makes more sense in wetter forests where trees last longer. In the Rockies, trees are generally not as long living as they are on the West coast, and also fire frequency is higher here. Research by Mark Harmon suggests that older west coast forests have such respiratory requirements that they are actually giving off some CO_2. However, it would take about 70 years for the slash (branches and twigs etc) to decompose (releasing CO_2) if these older forests were harvested.[26] Young forests are faster growing and sequester more carbon. Thinning can be an important means of ensuring forest health. Moving to a natural cycle would mean more fires. See AF12.

Research on urban forests has revised hardiness zone categories because of climate change.
Oregon did look into reforesting quickly after disturbance and reducing forest density to keep trees healthy. [27]

This option has a carbon co-benefit: a reduction in fire risk and loss of carbon sequestration, healthier forests, and protection of habitat, recreational opportunities, and rural housing.

---

[23] This option includes the old AF-25, 26, 27, and 33 options.
[24] Reforestation/Restoration of managed stands
[25] Thinning and Density Management of Managed Stands
[26] The group raised the possibility of using this material for cellulosic ethanol. See also AF1
[27]See Forests, Carbon and Climate Change, Oregon Forest Resources Institute, Oregon State Univ. (summary of larger report));

AF-11 – Develop and Implement Best Management Practices for Biomass Removal

This includes improved logging residue recovery to reduce decay at forest floor and develop feedstocks for energy production (renewable, carbon-neutral energy)[28]

Benefit/Cost of Reducing CO_2e:

Arizona:	Residential:	6.4 MMt between 2007-2020; $-21/ton
	Other:	2.9 MMt between 2007-2020; $-21/ton
New Mexico:	Residential:	2.5 MMt between 2007-2020; $-46/ton
	Other[29]:	6.3 MMt between 2007-2020; $-15/ton
Colorado:	less than 0.1-1.0 MMt[30]; uncertain cost	

Assessment: Medium Priority. Bin B.

This is an important, emerging issue nationwide. A major challenge with biomass is how to fund the cost of doing it and whether markets can be developed to pay for this. Options for reducing biomass include burning it, bringing in goats, or using mechanical means. The latter two are expensive. The decision to use fire must factor in how close the forests are to houses.

Biomass-specific best management practices (BMP) are needed.[31] There is nationwide interest in this type of BMP. Reducing decay to forest floor is largely a moisture issue. We may need a special set of rules for harvesting smaller diameter trees.

Woody biomass use is carbon neutral. To meet renewable energy targets, companies could mix woody biomass with coal to satisfy Oregon and California standards. The Utah state law providing for tax credits on renewable energy exempts wood and pellet stoves. Woody biomass must be used to produce some sort of fuel in order to qualify.

---

[28] Includes old options AF-39 and 42.
[29] Manage sustainable thinning to direct biomass towards wood products and renewable energy.
[30] Reductions depend on available acreage, current practice, and energy production.
[31] Current biomass BMP target reducing stream sediment. While this is a worthy goal, it does not get at the entire biomass issue.

AF-12 – Increase Fire Management and Risk Reduction Programs

Benefit/Cost of Reducing CO_2e:

Colorado: less than 0.1-1.0 MMt[32] between 2007-2020; uncertain cost
Oregon 3.2 MMt between 2007-2025; cost effective[33]

Assessment: High Priority. Bin A.

It is critical to avoid catastrophic carbon releases from forest fires.

Healthy forests take up carbon and sequester it, and healthy forests are less likely to burn. An entire forest could be lost in a fire. Reducing fires produces an important public safety benefit; other co-benefits are forest health, recreation, and wildlife.

Burning woody biomass is considered to be carbon neutral. If it is left it in the forest, it would burn or decompose anyway. If it is burned in a controlled fashion, there is less particulate.

Better funding and more research on the role of forest fires in climate change is needed.[34] Utah receives $1 million annual under the Federal fire plan. With a reduced budget, the focus is on the wildland-urban interface. Rural fires allowed to burn after years of fuel build-up burn unnaturally hot, baking the soil and killing trees that otherwise might not burn in a less hot fire. There is a need to reset the burning temperature by restoring a more natural fire regime.

There is a conflict with environmental advocates who oppose development of roads to fight fires, or to harvest any small diameter biomass, because affected lands can then no longer qualify for wilderness. Reducing fuels with natural or prescribed fire would still qualify these areas.

It is expensive to do mechanical thinning.[35] Some of the cost can be offset if the wood can be sold, but there typically aren't markets for forest biomass. Another "thinning" option is stewardship contracting – allowing timber companies to cut big trees to pay for the cost of removing the smaller ones, a move opposed by some environmental groups. Utah has signed a MOU that promotes the use of stewardship contracts. Agencies can retain receipts from harvesting and use them locally, unlike regular timber sales. There is also no need to award contracts to the lowest bid contractor, the state can consider other factors such as use of labor from to the local community.

[32] Reductions may be low because primary objective is not carbon sequestration.
[33] Creating a market for biomass from forests is key to this option. It would be important to locate biomass fueled generating plants close to forests to reduce the economic and GHG costs of shipping.
[34] See Steve Running's research on global warming and increasing forest fires.
[35] $900-1300/acre to thin

AF-13 – Increase Forest Health (pest/disease, invasive species) Risk Reduction Programs[36]

An umbrella option that includes:

- Drought management programs--tree selection, placement, protection against drought
- Flood and riparian management programs
- Watershed management programs – stand retention, enhancement and management

Benefit/Cost of Reducing CO_2e:

Colorado: less than 0.1-1.0 MMt; uncertain[37]

Assessment: High Priority. Bin A.

Healthy forests are of critical importance for carbon and other issues.

Healthy forests take up carbon and sequester it and are less likely to lose it catastrophically. Healthy grasslands and aspen may sequester more carbon than other mixes of trees and plants.

Aspens are declining throughout the West and no one apparently knows exactly why. Douglas fir forests are encroaching on aspen and they use more water. Cheatgrass increases risk of fire.

Carbon issues could be integrated with rangeland health, healthy watersheds, fisheries, and aspen concerns. The State should continue to support the Utah Watershed Initiative and the Utah Partnership for Conservation and Development.

This is also likely to be an issue in adaptation.

[36] This option combines the old AF 34, 35, 36, and 37 options
[37] A recent Colorado forest health report raises concerns. That state lost 1,000 square miles of forests due to multiple stresses of drought and beetles. Drought is the primary stress. When trees are weakened, beetles have more impact. It may be that warmer temperatures also increase the generations of beetles and fewer die during winter months.

AF-14 – Expand Use of Wood Products for Building Materials

Benefit/Cost of Reducing CO_2e:

Colorado: 0.1-1.0 MMt; uncertain[38]

Assessment: Medium Priority. Bin B.

The benefit of using wood in construction is that it sequesters carbon for a long time and minimizes the use of other materials, like steel, that release more carbon in production. It should also be noted, however, that expanding the use of forestry products means harvesting larger trees that sequester more carbon. It is important to distinguish between thinning and traditional forestry products use.

There are better uses for wood than just allowing it to create a fire hazard. However, Utah is not a big timber production state. Much of our woody material is non-merchantable and therefore cannot be readily adapted to building materials. It is difficult to assess the prospects for this in Utah. But public policies can help create opportunities for private timber production.

[38] Cost depends on the relative costs of materials.

AF-15 Expand Use of Forest Biomass Feedstocks for Energy Production (Fuel Switching)

Benefit/Cost of Reducing CO_2e:

Arizona:	4.5 MMt between 2007-2020; $-8/ton
New Mexico:	2.6 MMt between 2007-2020; $-76/ton
Colorado:	0.1-1.0 MMt or higher; less than $5-50/ton
Oregon:	3.2 MMt between 2007-25; cost effective

Assessment: Medium Priority. Bin D.

Wood biomass is important because it is carbon neutral and renewable. Incentives, such as tax credits, should be enhanced to encourage this option.

Oregon's assessment noted that creating a market for biomass from forests is key to this option. It is important to locate biomass fueled generating plants close to forests to reduce the economic and GHG costs of shipping.

Oregon is prohibited from purchasing CO_2 intense electricity. This has caused problems for IPP which is now considering co-firing with wood waste or other renewable sources.

The potential for economic extraction is unknown, and we need more information on the biomass inventory, in terms of what can be grown in Utah given water and other constraints, and what would be required to increase harvest at the scale to produce a significant amount of power. It can be costly and/or politically difficult to get product from forests to power generation facilities/energy consumption options.